THE WARRIOR

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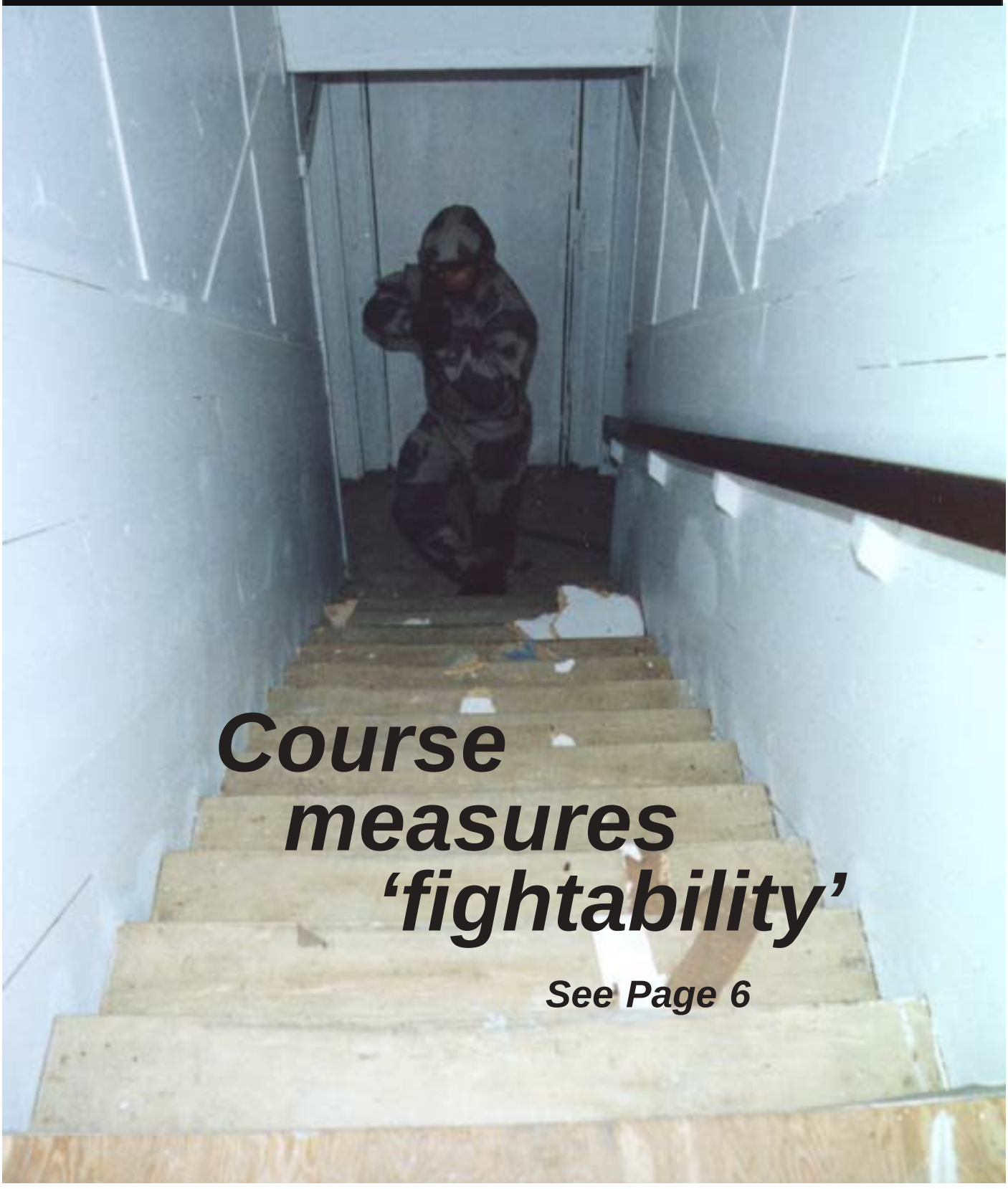

Course measures 'fightability'

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Cover photo: Dan Harshman, an equipment specialist with the Operational Forces Interface Group, walks up the interior stairway of the MOUT obstacle building in Hudson. (Warrior/Underhill)

THE WARRIOR
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CarboPack restores energy

By Curt Biberdorf
Editor

Extra energy for strenuous military operations is now conveniently supplied with the Carbohydrate Supplement Pack, or CarboPack, developed at the U.S. Army Soldier Systems Center in Natick, Mass.

The CarboPack contains one carbohydrate-rich bar and two packages of flavored carbohydrate-electrolyte sports beverage powder to mix two eight-ounce servings, and is intended to complement current and future military rations.

"Studies show that Soldiers in intense, prolonged physical activity for more than three hours need the calories beyond what's provided in rations," said Julie Edwards, a food technologist at the Department of Defense Combat Feeding Directorate here. "Most of what they need is provided in their rations. This is designed to make up the difference in calorie needs during prolonged exercise."

The CarboPack adds another 400 calories to the battlefield diet. By comparison, a day's worth of Meals, Ready-to-Eat (MRE) is more than 3,600 calories. Research that went into the CarboPack will give troops a product that's proven to perform while saving troops money.

"We identified a need because Soldiers were buying their own bars and drinks," Edwards said, which opened up potential pitfalls. "By providing soldiers with the right products we can decrease the chances that the Soldier will bring the wrong type of item to the field with them that may potentially hurt their performance."

Combat Feeding's Individual Combat Ration Team, the U.S. Army Research Institute of Environmental Medicine at Natick, Office of the Surgeon General and Army Center of Excellence Subsistence worked together on product guidelines.

The drink mix is similar to Gatorade, with a combination of electrolytes and carbohydrates meeting military specifications, according to Edwards, and has a lower sugar content than an MRE mix. Fruit punch, grape, orange and lemon-lime flavors were chosen because they are the most popular for this type of beverage, and each CarboPack holds two different flavors.

Each mix is stored in a trilaminate pouch with a tear-off top used to pour in water, shake and drink so warfighters can avoid using a separate drink holder, such as their canteen cup.

A resealable drink pouch was one of the recommendations of Soldiers from Fort Campbell, Ky., and Fort Polk, La., who participated in focus groups and evaluations, and is in development, Edwards said.

The drink pouches are folded over twice and fit inside another trilaminate pouch along with the bar wrapped in the original manufacturer's package.

Warrior/Underhill

The CarboPack combines two Gatorade-like drink mixes and an energy bar wrapped in a pouch.

Chocolate and apple cinnamon HooAH!, and oatmeal-raisin and chocolate bars similar to Gatorade and PowerBar brands were chosen as the energy bars because of their nutritional content, acceptability rating in taste-testing and ability to reach at least a two-year shelf life, Edwards said.

All three types in their respective flavors will be represented in the CarboPacks. Having a variety of products and flavors for the drinks and bars helps increase acceptability and consumption, she said.

HooAH! is a creation of the Combat Feeding food scientists and is getting another opportunity to be fielded as a new commercial manufacturer has picked up the production.

Another product evaluated was commercial gels, but they were a concern of the Soldiers because the gels would burst inside their full rucksacks, Edwards said. They will be considered again when the packaging of the product has improved.

The first 42,000 CarboPacks are scheduled for delivery to Iraq in January after receiving an urgent request last July for the product from the 101st Airborne Division and 3rd Corps Support Command.

Courtesy photo

A Soldier from the 82nd Airborne Division stands on a scale to weigh his approach march load in Kandahar, Afghanistan. The Soldier was among 764 paratroopers from the unit who were weighed in a study this past spring examining the dismounted infantryman's combat load.

Weighed down

Study suggests tapping vehicles to reduce heavy combat load

By Curt Biberdorf
Editor

Nowhere in Afghanistan did Lt. Col. Charles Dean see the folkloric 120-pound rucksack reputed to be carried by a dismounted infantryman in combat, but what these soldiers do carry continues to weigh too much.

Dean, an infantry officer serving as the Army's liaison to the Institute for Soldier Nanotechnologies at the Massachusetts Institute of Technology (MIT), presented findings of a study on the modern warrior's combat load at the U.S. Army Soldier Systems Center in Natick, Mass., Nov. 20.

He field trained and then led a team of seven carefully selected Airborne Rangers who volunteered to collect combat load data this past spring from paratroopers within the 82nd Airborne Division operating in Afghanistan.

They weighed combat loads and inventoried individual items of equipment carried by 764 out of 1,305 paratroopers assigned to the infantry rifle companies within Task Force Devil. Team members then packed the identical gear, rehearsed with the units and finally served as members of rifle platoons and squads within the task force on 15 separate dismounted combat missions against the enemy. Almost all of these operations included combat helicopter assault landings.

"If we want to reduce weight and bulk, you can throw a gazillion dollars into technology, but weight today is twice where it should be, and you can't reduce weight by technology alone," Dean said, who served at Natick as the Operations and Customer Interface director before his assignment at MIT. "The solution is to get the weight off the Soldiers. The reality is to accept that some things have to come off the guy's back."

He said the study, sponsored by the Center for Army Lessons Learned, collected historical information to help units in training, those going overseas into combat, and the people who research and develop new equipment.

Major findings from the study are:

■Soldiers have increased capabilities, but these continue to increase their weight burdens. It's weight, not capabilities, that wear out troops.

■Vehicles should be used to carry certain less essential items to reduce combat load.

■Body armor needs to be lightened. Its protective ability is well-documented, but it's uncomfortable and still heavy.

■Modern load carriage should continue to be improved.

■Soldiers are easily exhausted in extreme operations because of the climate and terrain. Daytime temperatures in Afghanistan during these springtime operations reached 116 degrees F. Nighttime temperatures plummeted enough to feel frigid.

"I think we can drop 10, 20, 30 pounds off these guys by paring down some items that they are currently carrying as long as these items are readily available when needed in a hurry," Dean said. "If we can offload some items, then we can work on reducing the weight of the remaining items through technology. The big monkey is to look at logistics and redesign logistics practices to get the weight off Soldiers."

The last time a comprehensive battlefield load study was conducted was in 1942 when the Marines executed their Making Island raid, according to Dean.

He said this recent study in Afghanistan appears to have been a first for the Army. Times have changed with better equipment and more of it.

Standards developed for the Army field manual titled "Foot Marches" printed in 1990 list maximum weights troops should carry for a fighting load, approach march load and emergency march load, figures determined with help from research at the Natick Soldier Center and U.S. Army Research Institute of Environmental Medicine.

A fighting load is everything worn or carried except a rucksack and should be held to less than 48 pounds, according to the field manual. The next level, approach march load, adds a light rucksack and should not exceed 72 pounds. In the worst-case scenario, emergency approach march loads require a larger rucksack, raising the total weight to 120-150 pounds.

Past research has provided more insight into combat loads. A British study from the 1920s concluded that the fighting load should not exceed 40-45 pounds, and S.L.A. Marshall, author of the 1950 book "The Soldier Load and the Mobility of a Nation," advised that the combat load should remain less than about 40 pounds.

Viewed another way, the load should not exceed 30 percent of a person's body weight when carrying an approach march load. Dean's team weighed and photographed troops at every level, from wearing only their basic uniforms and boots to what they carried for their emergency approach march loads for 29 different positions in rifle companies.

After reviewing the data, the average rifleman's fighting load was 63 pounds, which meant he was carrying on average 36 percent of his body weight before strapping on a rucksack. The average approach march load was 96 pounds or 55 percent of average rifleman's body weight, and the emergency approach march load average was 127 pounds or 71 percent of average rifleman's body weight.

Riflemen carried less weight than some soldiers, such as 60mm mortar squad leaders who on average carried emergency approach march loads of 142 pounds or 97 percent of the average mortar section leader's body weight.

Soldiers wore an approach march load most of the day, according to Dean, and even when not carrying a light rucksack, their fighting load at all times averaged more than 30 percent of their body weight.

"We were careful to get enough data to be significant," Dean said. "We're pleased we brought home enough data for the Army and Soldier Systems Center to use to better help the American soldier."

Courtesy photo

A squad leader with Task Force Devil uses sling rope to assist a Soldier crossing a stream in Afghanistan. At times, some Soldiers carry up to 150 pounds of clothing, equipment and supplies.

Course of study

'Fightability' of gear assessed through obstacles, former barracks

Story by Curt Biberdorf
Photos by Sarah Underhill

Developing the best clothing and individual equipment for the military consists of a multi-pronged approach, with laboratory research of physiology and biomechanics at the U.S. Army Soldier Systems Center in Natick, Mass., along with off-site field-testing and evaluation.

Constructed in 1998, the Clothing and Individual Equipment Fightability Course has provided another way to assess performance before fielding. Located 15 miles from the installation at the Hudson Annex, the course combines a series of obstacles along with buildings to simulate rural and urban terrain.

"The purpose of the course is to allow developers to do controlled studies in a somewhat realistic laboratory setting to quantify mobility, agility and ability to negotiate MOUT (Military Operations in Urban Terrain) obstacles," said John Kirk, Load Bearing and Individual Equipment Team leader, who created and manages the course.

Eight obstacles are spread along the fightability course. The entire course from start to finish as well as each individual event are clocked electronically with a light-beam-activated timer.

Once the site of various testing in airdrop, clothing and other studies, the fightability course is the last remaining research activity on the property.

Kirk learned about a vacant World War II era barracks scheduled for demolition on the site and thought it would make an ideal place for the course, which led to the salvage of the building and course construction.

Surrounded by several hundred acres of state-owned forest, the 1 1/2 acre rectangular course is bordered by a chain link security fence and contains eight obstacles along with the converted barracks and a smaller "Shoot House," which has catwalks and skylight windows on each side to enable observers to view training inside.

Obstacles allow test subjects to scale over a wooden fence, balance themselves as they walk along a log beam, charge over and down a ramped bridge, step through straddled tires, squirm through the pipe crawl, low and high crawl under wooden decks and jostle through clustered pipes, which represent a thicket of saplings, as quickly as possible.

The entire course from start to finish as well as each individual event are clocked electronically with a light-beam-activated timer.

Adjacent woods with trails or the 500-yard paved road on the perimeter enable researchers to incorporate road marching before sending troops through the course.

That gives engineers the ability to

compare pack designs to quantify the negative effects that road marching with that pack has on soldier performance, Kirk said, and having a paved perimeter road is helpful because they can monitor the test subjects closely, which is more complicated on a course on the trails. A timed course gives researchers quantitative measurements of fatigue.

A similar but smaller obstacle course is located at the Biomechanics Lab, a joint facility of the Natick Soldier Center and U.S. Army Research Institute of Environmental Medicine (USARIEM) at the Natick installation.

"(The Hudson course) gives us the ability to work with larger-scale obstacles. The two complement each other nicely," said Peter Frykman, a research physiologist with the Military Performance Division of USARIEM. "The nice thing about (the Hudson course) is the combination of the MOUT obstacles with the standard obstacles. Because both of these courses have road marching venues as part of them, we also get the chance to examine the role of fatigue in negotiating these obstacles."

He added that the course inside the Biomechanics Lab allows quality research to be completed during the inclement weather of winter. Access to these two courses provides the partnership between USARIEM and the Soldier Systems Center unique resources to investigate human performance with and without a load.

Unlike MOUT centers that resemble towns at places such as Fort Benning, Ga. or Fort Polk, La., MOUT at the relatively tiny fightability course is focused on equipment performance rather than tactical training.

The main two-story building has 4,000 square feet of space with rooms of various sizes. Since the building was vacant, conversion was simple, according to Kirk.

Timed MOUT obstacles incorporated into the building consist of stairways, doorways ranging from 24-36 inches wide that include one shaped like a ship's hatch, and windows of various widths and heights to capture as many variables as possible.

An existing building at the location has 4,000 square feet of space with rooms of various sizes and timed obstacles (above). The "Shoot House" was built new and is set up to observe urban warfare training.

The "Shoot House" was built new to augment the larger building.

"That's all for urban fighting, which the Army trains extensively for," Kirk said.

Products that can be evaluated span almost anything troops wear or carry, from helmets to boots. Frykman said it's a place that mimics the field without the time and expense to find a quick answer that can determine the direction of a project.

At least six studies with the ALICE, MOLLE, and developmental rucksacks with Marines from Camp Lejeune, N.C., and Special Operations SPEAR rucksack with Rangers from Fort Benning have been conducted since the course opened, Kirk said.

"We looked at how the volume of the pack affected performance and had (troops) running with different sized loads to determine their optimal load volume," he said. "Those studies resulted in technical reports on load-bearing equipment that are useful in defining requirements for pack designs. We've been able to make modifications to gear and product improvements."

Other uses for the MOUT building have been training for the Department of Defense police and Installation Defense Force who protect the Soldier Systems Center, as well as local police departments.

"A lot of times police have to use an old warehouse on a city block," Kirk said. "This gives them somewhere discreet in a secluded area."

Inflated tents

Future Medical Shelter System latest to use airbeam technology

By Curt Biberdorf
Editor

Unpack, unroll and inflate. With airbeams, setting up a soft shelter is that easy, and the Future Medical Shelter System is the latest effort of the Fabric Structures Team at the U.S. Army Soldier Systems Center in Natick, Mass., using the technology.

The Future Medical Shelter System is an advanced medical shelter designed to be the next-generation Chemically Protected Deployable Medical Systems (CP DEPMEDS) to improve shelter quality for medical personnel, according to Amy Leighton, a chemical engineer on the Fabric Structures Team.

"Our main driver is to allow Soldiers to rapidly deploy and allow medical personnel to quickly get to work in a clean environment," she said. "Even if there's not an immediate (chemical or biological agent contamination) threat, it gets them out of the dust and sand."

The current CP DEPMEDS connects a series of TEMPER tents and ISO containers linked together with passageways to offer nearly 32,000 square feet of treatment space. Up to 140 staff members can treat as many as 236 patients for three days in a clean, climate-controlled atmosphere.

As a forward-deployed combat support hospital, mobility is high priority. This type of treatment facility gives troops immediate medical care to stabilize them enough to transfer to a more permanent hospital if necessary, according to Leighton.

Reduced logistics and speedy setup and takedown are prominent advantages of the new system.

A 64-foot length of connected TEMPER tents takes 18 troops about 40 minutes to set up compared to four troops in 15-20 minutes for the same length of airbeam shelters. Instead of locating, connecting and inserting the metal frame parts into the TEMPER tents, troops handle a single item with four airbeams integrated into the rugged yet lighter fabric of each 32-foot section of the Future Medical System shelter.

Once spread out, the airbeams are inflated to 40 psi with a commercial air compressor that automatically shuts off when filled. A generator is needed to power the compressor, although one variation of the system uses a self-powered air compressor operating on liquid fuel. The tent is then anchored into the ground with stakes for stability.

Weight of the shelter plummets from nearly 2,700 pounds to 1,200 pounds. Manufactured by Vertigo, Inc. in Lake Elsinore, Calif., the braided high-strength polyester material of the airbeams has also cut the cost significantly and improved durability, Leighton said.

"Some people are under the impression that you have to frequently check the (air) pressure," she said. "It's a lot more reliable today. Leakage had been a problem. You had to check the pressure every few days to every few weeks, but we've had shelters like this up for months at a time without losing pressure."

Higher pressure allows the Future Medical Shelter System to be designed with four instead of eight airbeams. The Chemical and Biological Protected Shelter now fielded uses low-pressure beams while the developmental Wide Span

The Future Medical Shelter System rises as the airbeams are filled by a compressor during a demonstration at Natick in October (above). Within minutes, the shelter is up and ready to be filled with equipment to run a field hospital. (Courtesy photos)

Air Beam Shelter for aircraft maintenance uses high pressure.

In development for about one year, the Future Medical Shelter System was first demonstrated at the Soldier Systems Center in October. Two 32-foot by 20-foot modular airbeam tents were connected, representing pre- and post-operative care areas. Leighton said it's the first time two airbeam tents have been connected.

"This gives medical personnel an open architecture without connecting passageways or tent poles obstructing their view," she said. "That's important so that staff can see a larger area and watch patients more easily."

As with the CP DEPMEDS, a system of litter and ambulatory airlocks, protective entrances, blowers and filters will be included in the system.

Contaminated air is kept out by creating a steady overpressure by drawing in outside air, filtering it and then blowing it into the shelters. Lighting and power distribution are standard items with an optional hard flooring available.

The Fabric Structures Team and Vertigo have scheduled another demonstration of the Future Medical System in Fort Detrick, Md., in February. The next step will be to take shelters to training sites for further evaluation.

Although the major push is with medical shelters, shelters for other uses, such as command posts, may adopt the technology in years ahead, Leighton said.

Litter and ambulatory airlocks are installed at the end of the shelter (top). Lighting and power distribution are standard in the Future Medical Shelter System. (Courtesy photos)

Lunch box

Package carries complete 'kitchen' to distant troops

By Curt Biberdorf
Editor

Steam pouring out of this fiberboard box is no cause for alarm. It means lunch or dinner is almost ready.

The Remote Unit Self Heating Meal (RUSHM), also referred to as "Kitchen in a Carton," takes the hassle out of serving warfighters hot food in far away places by providing everything necessary to feed up to 18 troops in one tidy package.

Developed by the Department of Defense Combat Feeding Directorate at the U.S. Army Soldier Systems Center in Natick, Mass., the latest prototype of the remote meal reduces the carton's volume compared to previous prototypes by 20 percent by reconfiguring the package, trading larger dining trays for smaller ones, and swapping paper cups and beverage mixes for new resealable drink pouches.

"We've redesigned the whole module," said Lauren Milch, a physical scientist on the Equipment and Energy Team. "Reduction in cube and weight is critical because these are designed for remote units that may have to carry it out to the field with them. It could be airdropped or taken by vehicle, but in the worst case, they're walking out with it. We're still on the heavy side, but it's carryable."

Troops who don't have access to field kitchens, such as Signal units or Special Operations Forces, at best settle for hot food taken to them in thermal containers, only it's not always hot by the time the remote troops are located or are ready to eat the meal, said Milch.

Kitchen in a Carton fills the vacant niche in remote feeding rations for small groups because the troops heat it themselves when they are ready to eat.

"Overall, it was very well-received," said Peter Lavigne, a chemical engineer on the Equipment and Energy Team, referring to the latest RUSHM field evaluation with Rangers in Fort Lewis, Wash., in December 2003. "It clearly met the needs of remote group feeding with minimal logistical support."

Each 40-pound box contains four 6-pound polymeric meal trays, the same used in the Unitized Group Ration Heat and Serve, with a main entrée, starch, vegetable and dessert stacked upon each other.

These trays, plus heating elements and activator, comprise what is called the heating module. Squeezed into two sides of the box are 18 drink packs providing 12-ounce servings of a flavored beverage, 18 packages of candy, a serving spoon for each meal tray, a knife to slice open the tray lid, salt, pepper, a bottle of hot sauce, and18 dining trays and utensil packets with a fork, knife, spoon and napkin.

An instruction sheet is glued atop the heating module cover found within the outer carton. Within the heating module, each meal tray of food sits in a flameless ration heater tray activated when salt water saturates the chemicals.

Ripping out a plastic tab that extends through the heating module cover breaks a plastic pouch of water at each level to start the heating process. The heat of the shelf-stable tray rations is safely raised from 40 degrees to 140 degrees F in 30-45 minutes.

A technical challenge in the package design is to make the activating water pouches strong enough to survive shipping and handling yet easy enough to tear open when desired, according to Milch.

Another prototype uses an enclosed collapsible bottle containing salt that's filled with water and inserted into a tube on top when troops are ready to activate the heaters.

Pulling out the tab (above) on the heating module of the Remote Unit Self Heating Meal begins the heating process. Steam escapes from the modules as the temperature of the food trays rises to 140 degrees F in 30-45 minutes. (Courtesy photos)

This further reduces the overall weight of the RUSHM since it does not contain the activation water, and would ensure performance by eliminating the possibility of accidental activation during shipping and handling, according to Milch.

"The Soldiers liked having time to do other activities while the trays were heating," Milch said about feedback from the latest evaluation.

She said they also liked having everything in one box, the number of servings provided per box, the remote meal's size and weight, and the new drink packs, which are also being considered for use in other rations developed by Combat Feeding.

User suggestions for improvements included providing individual hot sauce bottles, a trash bag for food waste, wet napkins, slotted spoons and bread.

Now in the advanced development stage, the project has matured to the point that the team is working on creating menus, Milch said. Four varieties were available for the technical demonstration, but selections will expand to reflect menus similar to the Unitized Group Ration Heat and Serve.

Another demonstration is scheduled for this year to gather more data. Other potential changes include the use of group-serving pouched foods as an alternative to tray rations, which could be packaged in three pouches instead of four trays to further reduce weight, she said.

Courtesy photo

The latest prototype of the RUSHM consists of tray rations placed within heating trays (enclosed in box), candy, drink pouches, serving spoons, dining trays, utensil packets, salt, pepper and hot sauce.

"It's another option, and pouches heat more efficiently than the trays, which could further reduce the amount of activation water and chemical heater material needed," Milch said. "We're also testing a new type of flameless ration heater that's safer and more environmentally preferable."

The RUSHM could be available for purchase as soon as 2006.

Army Rangers serve dinner on a smaller serving tray (left) and tried a new drink pouch for the first time during a technical demonstration of the Remote Unit Self Heating Meal at Fort Lewis, Wash., in December 2003. (Courtesy photos)

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